

Revision of *Iviella* Lehtinen (Araneae: Dictynidae), with description of a new species from Newfoundland

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Abstract. The genus *Iviella* Lehtinen 1967 (Dictynidae) comprises three North American species, *I. ohioensis* (Chamberlin & Ivie 1935), *I. reclusa* (Gertsch & Ivie 1936) and a new species from the Northern Peninsula of Newfoundland. We provide a new diagnosis of the genus, describe the new species and describe the previously unknown male of *I. reclusa*. We also describe or re-describe the intricate copulatory ducts and spermathecae of the three species.

Keywords: *Iviella newfoundlandensis*, Canadian spiders, limited distribution

The genus *Iviella* Lehtinen has been poorly diagnosed (Bennett 2005) until now. It was created for two unusual species of the Dictynidae (Lehtinen 1967), based on both sexes of *I. ohioensis* (Chamberlin & Ivie 1935) but only females of *I. reclusa* (Gertsch & Ivie 1936). Chamberlin & Gertsch (1958) had placed both species in *Tricholathys* Chamberlin & Ivie 1935 because of the long, slender loop of the embolus of *I. ohioensis* and the supposedly diagnostic characteristics of the external female genitalia. However, Lehtinen (1967) recognized that the peculiar embolus in *I. ohioensis* is accompanied by a similarly elongated tegular apophysis, a characteristic he regarded as indicative of generic distinctness. Discovery of male *I. reclusa* in Saskatchewan and examination of the details of the convoluted copulatory ducts and spermathecae of females has helped to more clearly delineate *Iviella* and allowed us to recognize a third species.

In this paper we describe (or re-describe) the complex female genital anatomy and the male palp of *I. ohioensis*, *I. reclusa* and *I. newfoundlandensis* new species. The species are diagnosed, a key is given for their identification and a map of collection localities is provided.

METHODS

Definitions of measurements used.—Carapace width: measured at the widest point, in dorsal view; Cymbium length: measured in dorsal view; Overall length of spider: measured from anterior edge of carapace (excluding legs and palps) to posterior end of abdomen (excluding spinnerets if visible dorsally) viewed dorsally with body in one plane (i.e., with long axes of both cephalothorax and abdomen in the same plane); for other technical terms we have followed the glossary in Ubick et al. (2005).

Abbreviations used in text.—AMNH: American Museum of Natural History, New York, New York; DB: D. Buckle collection, Saskatoon, Saskatchewan, Canada; RMNL: The Rooms Provincial Museum, St. John's, Newfoundland and Labrador, Canada (in previous publications this collection was referred to as the J.R. Pickavance collection); CNC: Canadian National Collection of Insects and Arachnids, Ottawa, Ontario.

TAXONOMY

Family Dictynidae O. Pickard-Cambridge 1871
Genus *Iviella* Lehtinen 1967

Type species.—*Argenna ohioensis* Chamberlin & Ivie 1935. Designated by Lehtinen 1967.

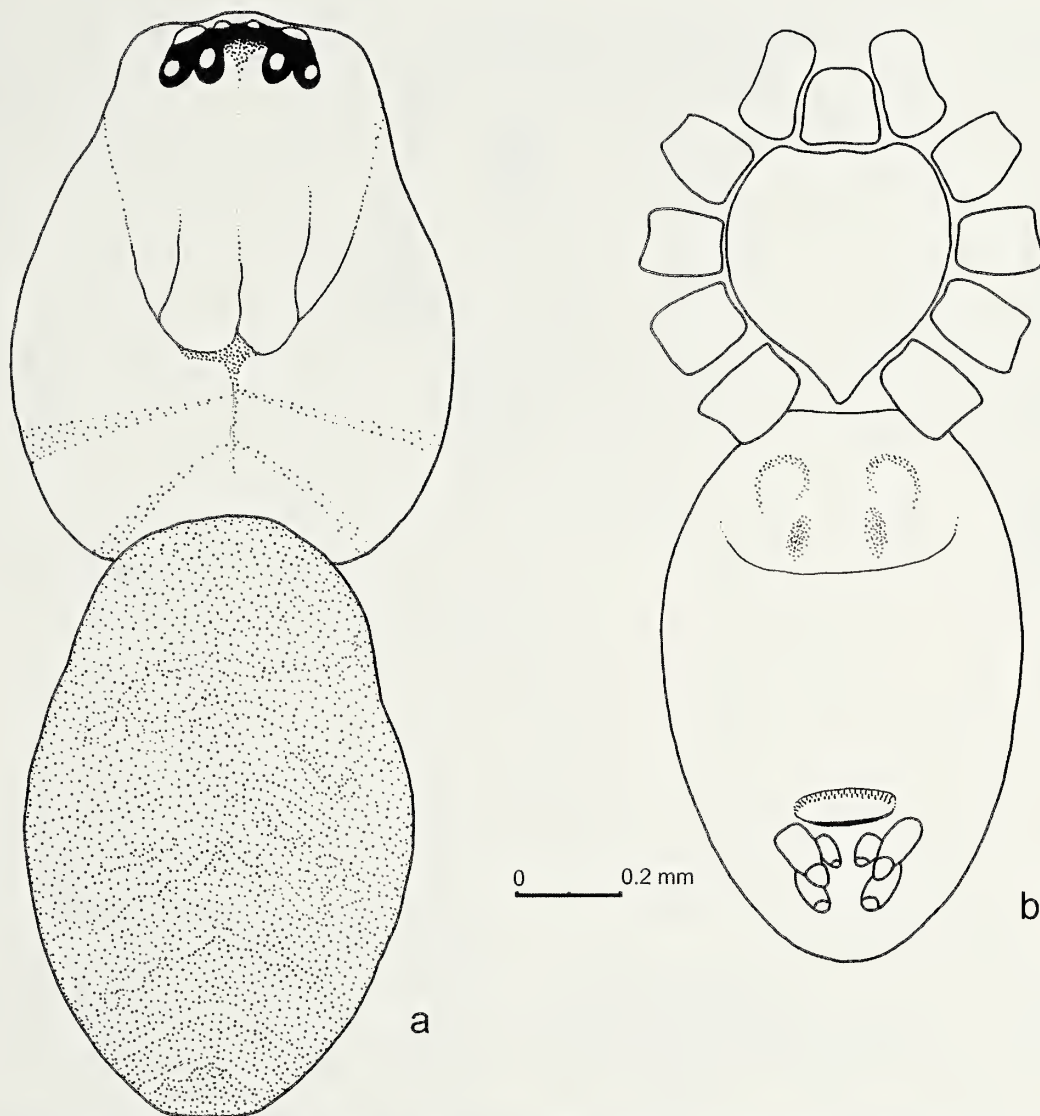
Iviella: Lehtinen 1967:241.

Iviella: Bennett 2005:99.

Description of the genus.—General characters as for the family (Bennett 2005). Small (overall length 1.68–3.72 mm; carapace width 0.531–1.14 mm), cribellate dictynids. Shape uniform and without unusual features (Figs. 1a, 1b). Carapace and sternum pale to dark amber, glabrous except for occasional setae around the fovea and anterior to the eyes, with a dorsal, branched trident-mark (Fig. 1a) varying from nearly invisible to dark and pronounced. Abdomen dorsally and ventrally finely setose, pale to dark brown, with ill-defined, paler lines and spots which may approximate to chevrons dorso-posteriorly (Fig. 1a), but are elsewhere asymmetrical. Cribellum entire and evident in both sexes; calamistrum obvious in females, but ill defined in males.

Adult male palpal tarsus with tegular apophysis and embolus forming a conspicuous, elongated loop extending at least slightly and at most obviously beyond the distal end of the cymbium (Figs. 2a–c). Epigynal atria widely spaced, inconspicuous, with lightly sclerotized rims (Figs. 1b, 4a–d). Copulatory openings within or at the margin of the atria; usually indistinct and difficult to see. Copulatory ducts invisible or at best partially visible externally in undissected specimens, fully visible only by dissection and clearing. Copulatory ducts long and coiled, each about 5.5–13 times as long as a spermatheca according to species (Figs. 4a–d). Spermathecae in undissected specimens visible externally as blurred outlines with orientation varying between parallel and 90° to the long axis of the body (Fig. 1b).

Diagnosis.—*Iviella* is distinguished from other genera in the family by the following combination of characters: Eight eyes. Cribellate, with cribellum entire. Tarsi with trichobothria, which may be indistinct on tarsi III and IV. Anterior one-third



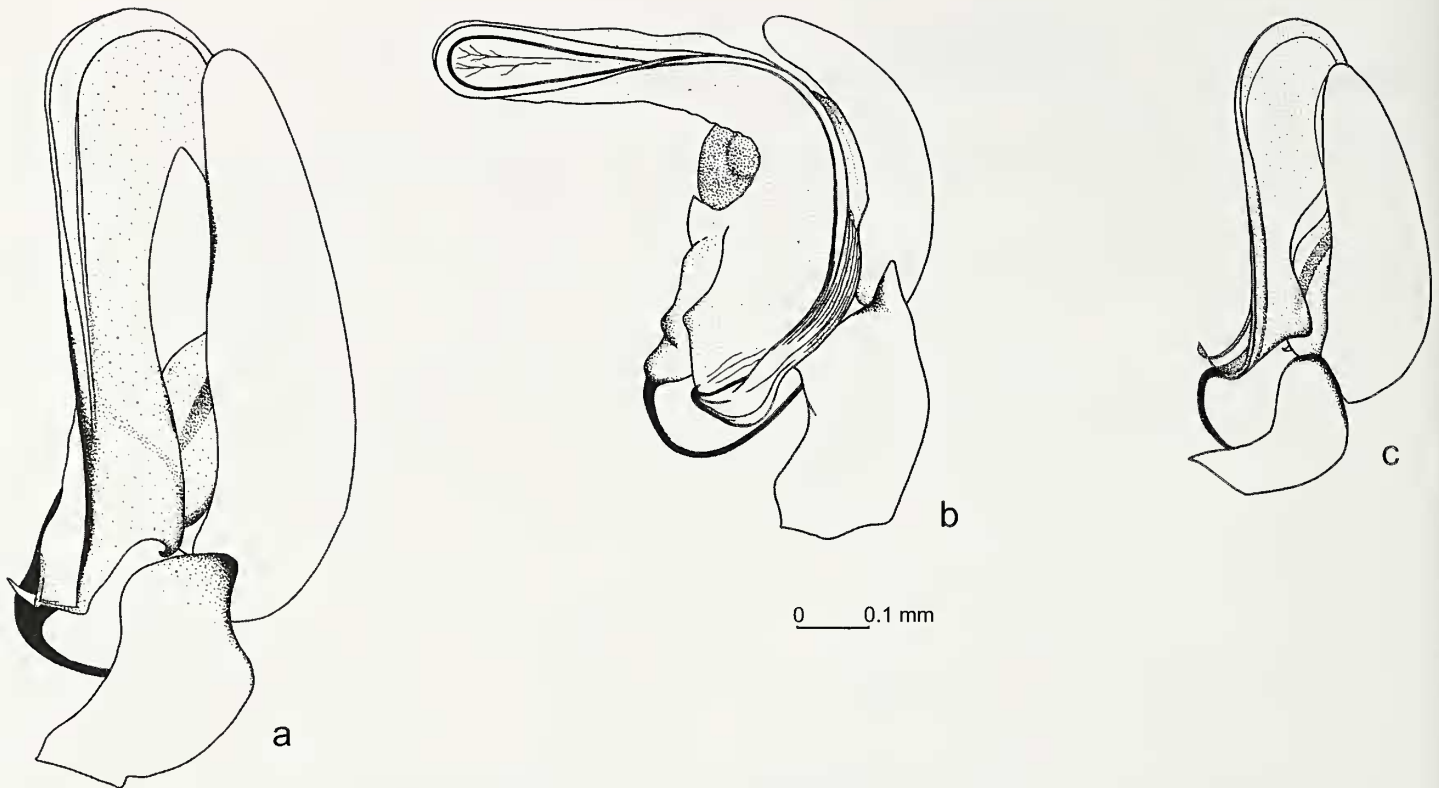
Figures 1a, b.—General external morphology of *Iviella* illustrated by two species. a. *I. ohioensis* ♀ dorsal view; b. *I. reclusa* ♀ ventral view (Saskatchewan specimen). Scale = 0.2 mm.

of carapace not elevated more than the middle one-third. Clypeus low, equal to or less than diameter of the anterior lateral eyes. Retro-margin of cheliceral fang furrow with 3 or 4 teeth. Tegular apophysis of male palpal tarsus extending

beyond the distal margin of the cymbium by 20–100% of the length of the cymbium, and with proximal end not an obvious loose coil. Copulatory ducts of female long and coiled, each at least five times the length of a spermatheca.

KEY TO SPECIES OF *IVIELLA*

- 1. Female 2
- Male 4
- 2. Spermathecae lying approximately 90° to long axis of body (Fig. 4b) *I. ohioensis*
- Spermathecae approximately parallel (Fig. 4c) or at 45° to long axis of body (Fig. 4a) 3
- 3. Spermathecae approximately parallel to the long axis of body (Fig. 4c); smaller species, overall length about 1.7–2.1 mm *I. reclusa*
- Spermathecae oriented between about 45° and sub-parallel to long axis of body (Fig. 4a); larger species, overall length about 2.8–3.8 mm *I. newfoundlandensis*
- 4. Tegular apophysis about twice as long as cymbium and bent through about 90° between proximal and distal ends (Fig. 2b) *I. ohioensis*
- Tegular apophysis not twice as long as cymbium and not bent through 90° between proximal and distal ends (Figs. 2a, 2c) 5
- 5. Retrolateral tibial apophysis smoothly rounded (Fig. 3c); smaller species, overall length about 1.8–2.4 mm *I. reclusa*
- Retrolateral tibial apophysis bluntly pointed (Fig. 3a); larger species, overall length about 2.8–3.4 mm *I. newfoundlandensis*



Figures 2a–c.—Male *Iviella* palpal tarsi, retrolateral views. a. *I. newfoundlandensis* ♂; b. *I. ohioensis* ♂; c. *I. reclusa* ♂ (Saskatchewan specimen). Scale = 0.1 mm.

Iviella ohioensis (Chamberlin & Ivie 1935)

Figs. 1a, 2b, 3b, 4b.

Argenna ohioensis Chamberlin and Ivie 1935:26, pl.12, figs. 93, 94♂ (but not fig. 92 as stated on p. 26); Bonnet 1955:665.

?*Tricholathys ohioensis* Chamberlin 1948:17 (Note: in this paper Chamberlin refers to *ohioensis* while describing the new species *Tricholathys saltona*: "... conductor and embolus well developed but less so than in *ohioensis*...". Whether he intended *ohioensis* to be included under *Tricholathys* is not clear. However, Platnick (2009) includes this reference as *Tricholathys ohioensis*); Roewer 1954: 1335; Chamberlin and Gertsch 1958:24, pl. 2, figs. 6, 8 ♂, fig. 7♀; Kaston 1976:58, figs. 69♂, 70♀ (illustrations after Chamberlin and Gertsch 1958).

Iviella ohioensis Lehtinen 1967:241; Bennett 2005:99, figs. 25.41♂, 25.42♀.

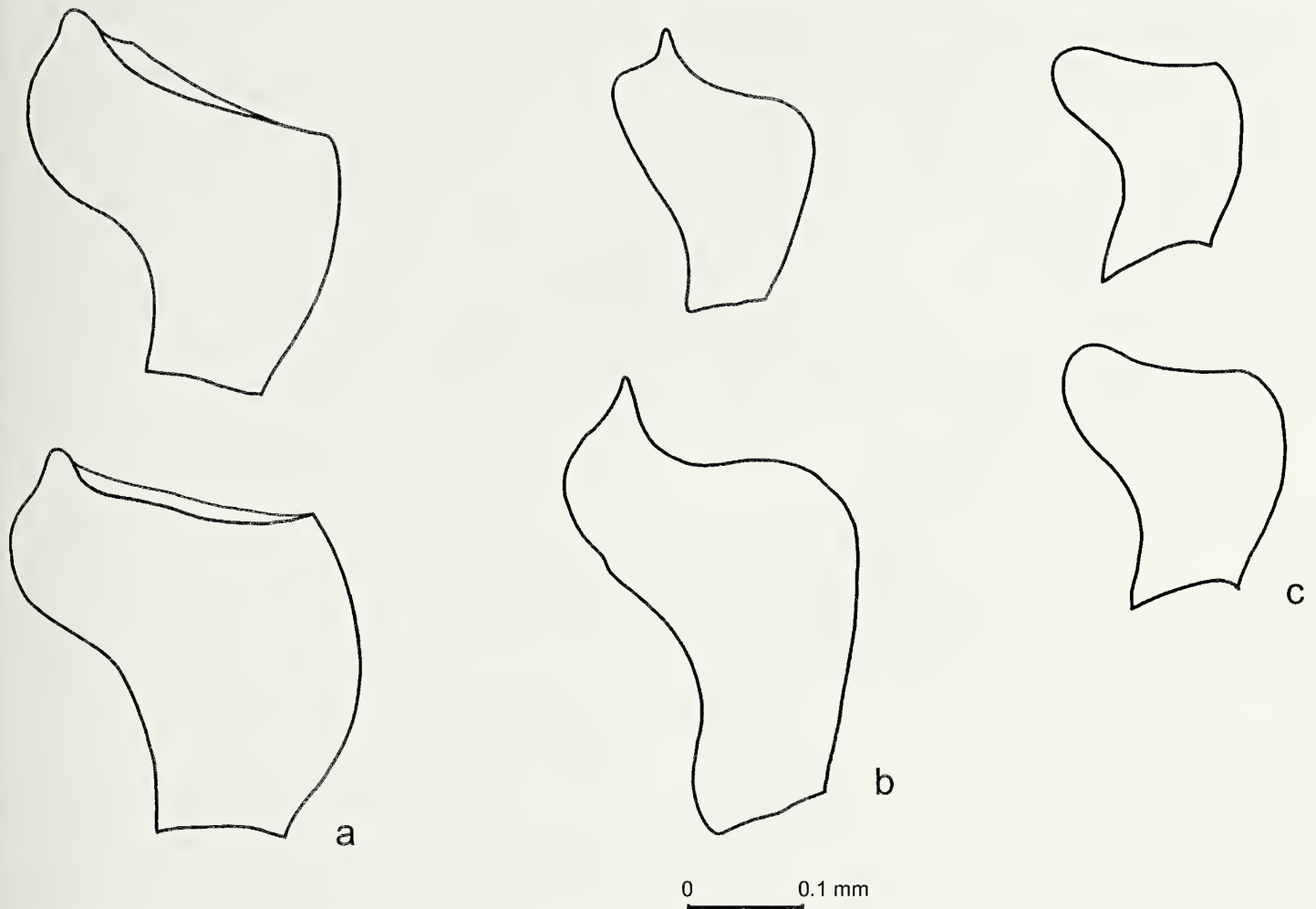
Description.—General characters as for the genus. Male ($n = 6$): overall length 1.72–2.25 mm; carapace width 0.622–0.824 mm; cymbium length 0.385–0.476 mm. Tegular apophysis extending beyond distal end of cymbium by approximately the length of the cymbium. Tegular apophysis bent through about 90° between proximal and distal ends (Fig. 2b). Palpal tibia with characteristic shape in dorsal view with a sharply pointed retrolateral tibial apophysis (Fig. 3b). Female ($n = 4$): overall length 1.96–2.14 mm; carapace width 0.622–0.659 mm. Spermathecae 0.052–0.065 mm wide by 0.081–0.112 mm long. Spermathecae with long axes approximately 90° to long axis of body (Fig. 4b). Copulatory duct about 12–13 times as long as the length of a spermatheca. Copulatory openings and ducts as in Fig. 4b.

Distribution.—USA: Ohio, Nebraska, West Virginia, New Jersey and Kansas (Fig. 5).

Habitat.—The habitat appears to vary: prairie, mixed oak-hardwood and parkland. The nature and placement of the web is unknown.

Material examined.—In this section and similar sections elsewhere the lack of uniformity of style in the presentation of data from different vials and collections is because we have in all cases quoted the original vial labels verbatim. The only exception to this policy is where we have added the location of the collection (see abbreviations above) where specimens are housed. USA: Holotype: 39N, 83W, Ohio, Columbus, 1 May 1933, (W. M. Barrows) 1♂ AMNH. Paratype: 39N, 83W, (label in microvial: 39Bd28) 1♂ AMNH. Kansas, Sallyards, 37.47N, 96.30W, 26 April 1962, 1♀ (W. Ivie) AMNH. Nebraska, Lincoln, prairie pitfall, 6 May 1939, 1♂ (E. Fichter) AMNH. Nebraska, 9 mi NW Lincoln, pitfalls on prairie, 40N, 96W, 3 June 1939, 2♀ (E. Fichter) AMNH. New Jersey, Ramsey, July 1939, 1♀ (W.J. Gertsch) AMNH. Ohio, Franklin Co., Sharon Woods Metropolitan Park 0.8 km south of Park Road Entrance sta 18, 8–15 May 1973 1♂ (A.J. Penniman) AMNH. Ohio, Franklin Co., Sharon Woods Metropolitan Park 0.8 km S of Park Road Entrance sta 19, 8–15 May 1973 1♂ (A.J. Penniman) AMNH. West Virginia, Preston Co., WV University Forest Chestnut Ridge, Mixed oak-hardwood, Stand 7 plot 20, pitfall trap, 1–8 May 1990, 1♂ (D.T. Jennings) AMNH.

Diagnosis.—Males of *I. ohioensis* are distinguished from those of both *I. reclusa* and *I. newfoundlandensis* by the 90° bend of the tegular apophysis (Fig. 2b) and the more sharply pointed retrolateral tibial apophysis (Fig. 3b). Female *I.*



Figures 3a–c.—Male *Iviella* palpal tibia showing retrolateral tibial apophysis (larger and smaller examples shown for each species to illustrate variation). a. *I. newfoundlandensis* ♂; b. *I. ohioensis* ♂; c. *I. reclusa* ♂ (Saskatchewan specimen). Scale = 0.1 mm.

ohioensis are distinguished from both *I. reclusa* and *I. newfoundlandensis* by the spermathecae lying with their long axes approximately 90° to the long axis of body (Fig. 4b).

Iviella reclusa (Gertsch and Ivie 1936)
Figs. 1b, 2c, 3c, 4c, 4d.

Argemina reclusa Gertsch & Ivie 1936:3, figs. 19, 20♀;
Chamberlin 1948:6; Roewer 1954:1335; Bonnet 1955:667.

Tricholathys reclusa Chamberlin & Gertsch 1958:24, pl. 2, fig. 9♀.

Iviella reclusa Lehtinen 1967:241; Bennett 2005:99.

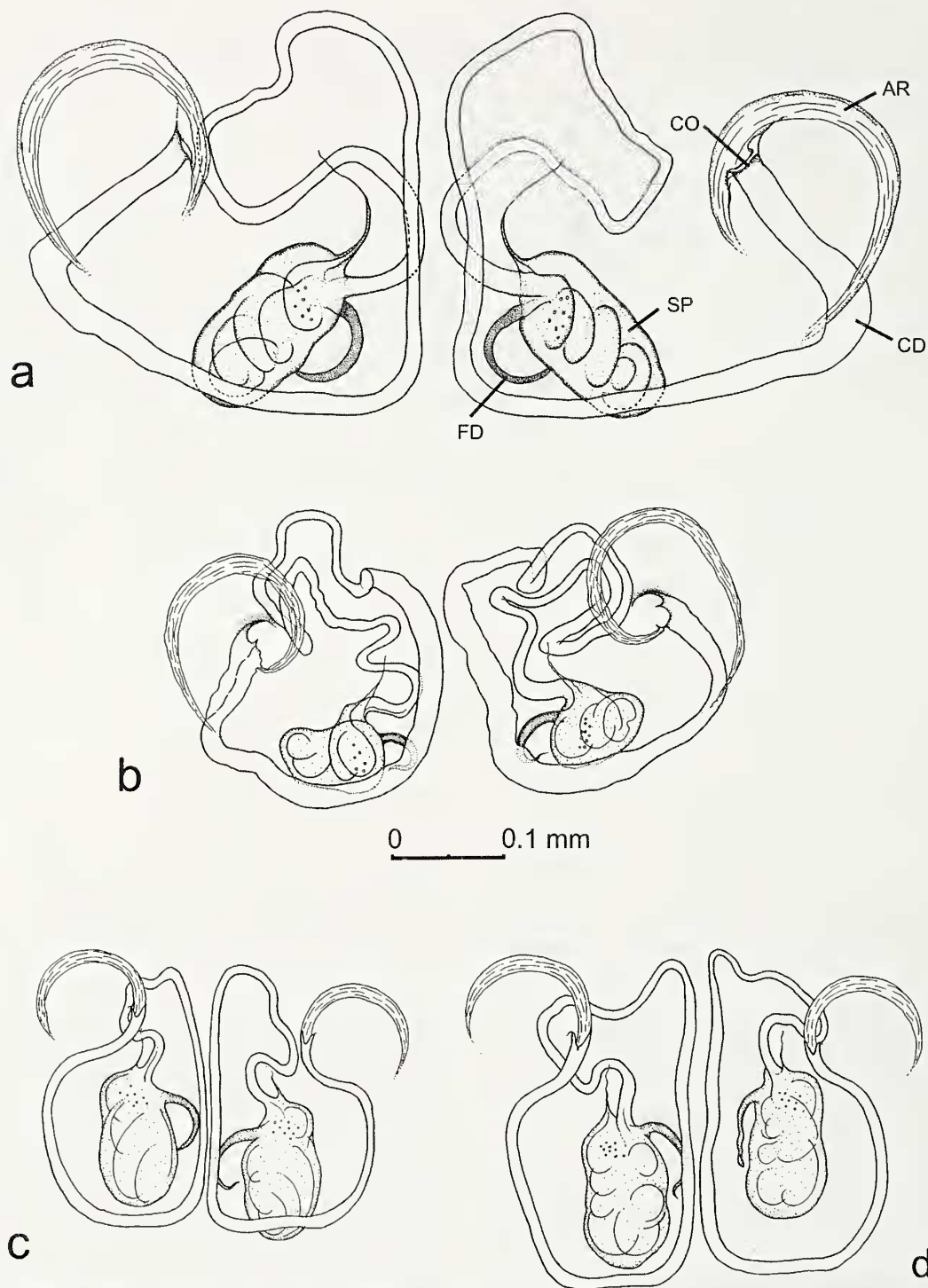
Description.—General characters as for the genus. Male ($n = 17$; all Saskatchewan specimens): overall length 1.81–2.62 mm; carapace width 0.622–0.952 mm; cymbium length 0.439–0.540 mm. Tegular apophysis extending beyond distal end of cymbium by approximately 15–20% of length of cymbium, and not bent between proximal and distal ends (Fig. 2c). Palpal tibia with characteristic shape in dorsal view with a smoothly rounded retrolateral tibial apophysis (Fig. 3c). Female ($n = 20$; 3 USA specimens, 17 Saskatchewan specimens): overall length 1.68–2.51 mm; carapace width 0.531–0.732 mm. Spermathecae 0.065–0.075 mm wide by 0.112–0.130 mm long, with long axes approximately parallel to

long axis of body (Figs. 4c, 4d). Copulatory duct about 5.5–7 times as long as the length of a spermatheca. Copulatory openings and ducts as in Figs. 4c, 4d.

Distribution.—USA: Utah, Arizona; Canada: Saskatchewan (Fig. 5).

Habitat.—Other than the geographical location, we have no information about the habitat of the USA specimens. The Saskatchewan specimens are from various types of grassland: prairie and grazed prairie, crested wheatgrass, and a flooded grassy area. The nature and placement of the web is unknown.

Material examined.—USA: Holotype: 38N, 112W, Utah, 10 mi N Cove Fort, 15 April 1933 1♀ (W. Ivie) AMNH. Arizona, 20 mi S Flagstaff, Oak Creek Canyon, 12 April 1935, 2♀ (W. Ivie) AMNH. Note: Chamberlin & Gertsch (1958) reported an immature male: Arizona, 4 mi SE Ruby, 5 Sep 1950 (W.J. Gertsch) AMNH. They called it a penultimate stage male, probably *I. reclusa*. We examined this specimen and do not think it is in the penultimate stage because no internal details of the swollen palps are visible externally as is the case with late-stage males of other species of *Iviella*. Therefore, although this specimen might be an immature *I. reclusa*, it will not be referred to further because it is impossible to be certain of its specific identity. CANADA:



Figures 4a-d.—Female *Iviella* epigyna, spermathecae and associated ducts (drawn from dissected, cleared and mounted parts of specimens with consequent risk of distortion). a. *I. newfoundlandensis* ♀; b. *I. ohioensis* ♀; c. *I. reclusa* ♀ (holotype, USA); d. *I. reclusa* ♀ (Saskatchewan specimen). Scale = 0.1mm. AR = atrial rim, lightly sclerotized; CO = copulatory opening; CD = copulatory duct; FD = fertilization duct; SP = spermatheca.

Saskatchewan, 10 km S Cadillac, Auvergne prairie, pittraps, 21–27 June 1995, 1♂ (J. Pepper) DB. Saskatchewan, Grasslands National Park, 49°10.7'N, 107°24.4'W, crested wheatgrass, pittraps, 1–27 July 1996, 8♀ 11♂ (A. T. Finnamore) (label says 9♀, but only 8♀ in vial) 3♀ RMNL, remainder DB. Saskatchewan, Grasslands National Park, 49°8.4'N, 107°35.8'W, crested

wheatgrass, pittraps, 5–13 July 1996, 2♀ (A. T. Finnamore) DB. Saskatchewan, Grasslands National Park, 49°7.9'N, 107°36.0'W, crested wheatgrass, pittraps, 5–19 July 1996, 6♀ 4♂ (A. T. Finnamore) 1♂ 1♀ CNC, 1♂ RMNL, 1♂ 1♀ AMNH, remainder DB. Saskatchewan, Grasslands National Park, 49°11.4'N, 107°22.6'W, grazed prairie, pittraps, 11–14 July



Figure 5.—Collection localities of *Iviella* species. (Map courtesy of P. Paquin.)

1996, 1♂ (A.T. Finnamore) DB. Saskatchewan, Val Marie, flooded grassy area, 30 May 1985, 1♀ (K. Roney) DB.

Diagnosis.—Males of *I. reclusa* are distinguished from those of *I. ohioensis* by the straight tegular apophysis (i.e., not bent through 90°) (Fig. 2c) and the smoothly rounded retrolateral tibial apophysis (Fig. 3c). They are distinguished from males of *I. newfoundlandensis* by the smoothly rounded retrolateral tibial apophysis (Fig. 3c) and smaller size: shorter overall, with narrower carapace and shorter cymbium (Table 1). Female *I. reclusa* are distinguished from both *I. ohioensis* and *I. newfoundlandensis* by the spermathecae lying with their long axes approximately parallel to the long axis of body (Figs. 4c, d).

Iviella newfoundlandensis new species

Figs. 2a, 3a, 4a.

Iviella sp.: Bennett 2005:99, fig. 25.43♀; Pickavance & Dondale 2005:258.

Types.—All types: CANADA: *Newfoundland*, Point Riche, NE of lighthouse, upper terrace (50°42.2'N, 57°24.1'W), rocky *Empetrum* barrens, hand caught, collector J.R. Pickavance. Holotype and female paratype: 19 August 2000, deposited CNC. Male and female paratype: 19 August 2000, deposited AMNH. Male and female paratype: ♂ 19 August 2000, ♀ 20 August 2002, deposited RMNL.

Etymology.—Named for the island where it was discovered and for the respect and affection the authors feel for the people of that island.

Description.—General characters as for the genus. Male (*n* = 25): overall length 2.89–3.41 mm; carapace width 1.01–1.21 mm; cymbium length 0.677–0.824 mm. Tegular apophysis extending beyond the distal end of the cymbium by about 10–15% of the length of the cymbium; not bent between proximal and distal ends (Fig. 2a). Palpal tibia with characteristic shape in dorsal view with a bluntly pointed retrolateral tibial

Table 1.—Comparative measurements of *Iviella* species (USA and Saskatchewan, Canada specimens of *I. reclusa* kept separate for future reference). All measurements in mm. OVL = overall length; CW = carapace width; SPW = spermatheca width; SPL = spermatheca length; CBL = cymbium length.

Females	OVL	CW	SPW	SPL
<i>I. newfoundlandensis</i>	2.86–3.72	0.952–1.14	0.089–0.109	0.169–0.195
<i>I. ohioensis</i>	1.96–2.14	0.622–0.659	0.052–0.065	0.081–0.112
<i>I. reclusa</i> (USA)	1.76–2.08	0.531–0.640	0.074–0.075	0.120–0.124
<i>I. reclusa</i> (Sask.)	1.68–2.51	0.531–0.732	0.065–0.075	0.112–0.130
Males	OVL	CW	CBL	
<i>I. newfoundlandensis</i>	2.89–3.41	1.01–1.21	0.677–0.824	
<i>I. ohioensis</i>	1.72–2.25	0.622–0.824	0.385–0.476	
<i>I. reclusa</i> (Sask.)	1.81–2.62	0.622–0.952	0.439–0.540	

apophysis (Fig. 3a). Female ($n = 25$): overall length 2.86–3.72 mm; carapace width 0.952–1.14 mm. Spermathecae 0.089–0.109 mm wide by 0.169–0.195 mm long with long axes between about 45° to sub-parallel to long axis of body (Fig. 4a). Copulatory duct about 8.5–9.5 times as long as the length of a spermatheca. Copulatory openings and ducts as in Fig. 4a.

Distribution.—Canada: Newfoundland, Northern Peninsula (Fig. 5).

Habitat.—*Empetrum* barrens with stones and rocks of various sizes, particularly but not exclusively near the coast. In areas where the species occurs it is easily found by turning over stones. Smaller stones (e.g., 10–20 cm) will typically harbor only one spider, while larger stones (e.g., 30–50 cm) may have two or more. The presence of a specimen is indicated by a small, gauzy web, and close inspection often reveals an inconspicuous spider at one side. The web may be either on the undersurface of the turned-over stone or (more often) slung between smaller stones beneath.

Material examined.—CANADA: Newfoundland (all collections except where noted caught by hand by Pickavance): Point Riche, NE of lighthouse, upper terrace (50°42.2'N, 57°24.1'W), rocky *Empetrum* barrens: 24 Jul 1998, 5♀; 17 Aug 1998, 1♂; 28 Jun 1999, 1♀; 2 Aug 1999, 15♀; 25 Jun 2000, 3♀; 15 Jul 2000, 3♀; 24 Jul 2000, 4♀; 29 Jul 2000, 16♀; 12 Aug 2000, 17♀1♂; 18 Aug 2002, 17♀5♂ RMNL. 19 Aug 2000, 44♀18♂: 1♂CNC; 1♂AMNH; 1♂DB; 2♀CNC; 2♀AMNH; 1♀DB, remainder RMNL. 20 Aug 2002, 14♀3♂: 1♀DB, remainder RMNL. Point Riche, SE of lighthouse, lower coastal terrace (50°41.8'N, 57°23.3'W), rocky *Empetrum* barrens: 2 Aug 1999, 1♀; 4 Aug 2000, 1♀; 8 Jul 2004, 61♀ RMNL. Point Riche, Phillips Garden (50°42.9'N, 57°23.1'W), rocky *Empetrum* at back of beach, 5 Jul 2004, 4♀1♂ RMNL. Table Point (50°22.5'N, 57°31.6'W), coastal rocky *Empetrum* barrens: 30 Sep 1998, 1♂; 16 Aug 1999, 1♀ RMNL. Eddies Cove East, 17 km inland (east) from the community (51°22.7'N, 56°13.1'W), rocky *Empetrum* barrens, 21 Jun 2000, 1♀ RMNL. Burnt Cape (51°22.7'N, 56°13.1'W), rocky *Empetrum* barrens, pitfall traps, Aug 2003, 1♀5♂ (A.-M. Hynes) RMNL.

Diagnosis.—Males of *I. newfoundlandensis* are distinguished from those of *I. ohioensis* by the straight tegular apophysis (i.e., not bent through 90°) (Fig. 2a) and the bluntly pointed retrolateral tibial apophysis (Fig. 3a). They are distinguished from males of *I. reclusa* by the bluntly pointed retrolateral tibial apophysis (Fig. 3a) and larger size: longer overall, with wider carapace and longer cymbium (Table 1). Female *I. newfoundlandensis* are distinguished from both *I. ohioensis* and *I. reclusa* by the spermathecae lying with long axes between about 45° to sub-parallel to long axis of body (Fig. 4a).

DISCUSSION

This paper hinges on our assignment of Saskatchewan *Iviella* males to *I. reclusa* because of their close association with female *Iviella*, which in turn are considered conspecific with female *I. reclusa* from the USA. The females are considered conspecific because of the similarity in shape, size and orientation of the spermathecae and copulatory ducts (Figs. 4c, 4d; Table 1). However, there are rare cases in the Araneae where males of closely related species are distinguishable but the females are not. For example, males of *Pirata*

insularis Emerton 1885 and *P. cantralli* Wallace & Exline 1978 (Lycosidae) are morphologically distinguishable but the females are not and can only be assigned to species by association with the male (Dondale & Redner 1990). There is therefore the possibility that in future *Iviella* males will be found in close association with females from one of the known USA localities (Arizona and Utah), which will be different from the Saskatchewan males. In this case the Saskatchewan specimens will need to be described as a separate, new species (hence distinguishing between USA and Saskatchewan specimens in the figures and keeping the data separate in Table 1).

Although the new species *I. newfoundlandensis* is known only from Newfoundland, we do not consider this a case of endemic speciation because of the recent (geologically speaking) glaciation of the Island of Newfoundland (Dyke et al. 2002). Rather, we think this is simply a case of a boreal or sub-arctic species that possibly has a wider distribution, but has been overlooked elsewhere. Part of why this species has not been found previously may be because of its reluctance to fall into pitfall traps. The senior author has regularly caught this species by hand in close proximity to pitfalls in which not a single specimen was taken over a period of 10 weeks. The six Newfoundland specimens found in a pitfall are very much the inexplicable exception to a general rule.

This study was made difficult by the lack of specimens for dissection and comparison. Before this study, no male and only three female *I. reclusa* were known, and recent intensive searches of one of the two recorded USA localities of this species (Oak Creek Canyon, Arizona), undertaken specifically for this study, failed to reveal further specimens. There are only 10 known specimens of *I. ohioensis*. The new species from Newfoundland described here is known from only a small number of localities, although it can usually be found if a specific habitat is searched.

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